data must then be maintained. The TIS database consists of the following primary components: road network data; linear referencing methods; road characteristic, and other event data; and other spatial data. Each of these categories of data requires maintenance procedures specific to the type of data. It will be apparent to one skilled in the art how to maintain the varying types of information based on the database architecture.

[0093]   The means by which the TIS data is maintained in the TSAF database is the data model of the present invention. An exemplary embodiment of this data model is described below.

Model Overview

[0094]   The TSAF database and software establish a spatially-enabled database that provides enterprise-wide access to data tied to the road network. The Oracle® database engine supplemented by the ESRI, Inc. Spatial Data Engine (SDE) middle-ware provides the core database functionality for this system. This functionality is extended to provide enterprise-wide access to the data through custom map, report, and data server applications that can be accessed through a Web browser. These elements form the technology base for the system. Because an off-the-shelf database (e.g. Oracle) and off-the-shelf spatial data engine (e.g., SDE middle-ware from ESRI, Inc.) are used, the system is implemented using an open architecture which allows easy access to the TIS data. The following elements are added to this open technology base to deliver the complete system and method:

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[0095] 1. **The Road-Division Data Model**. The road network is of central concern to users of the data, and the Road-Division Data Model describes how a road network is represented in the database. The primary element of this data model is the Division Section, which represents a physical, linear section of a division of a roadway. Division Sections are linked by Division Nodes, which specify the points at which Division Sections intersect. This representation differs from the traditional link-node networks in that (a) a division node can occur in the interior of a Division Section and (b) the Division Section-Division Node network is specifically designed to represent a road network. This base is completed with (i) road Sections that represent linear sections of a roadway by combining the road division data of Division Sections, (ii) traversals that represent roads and road divisions, (iii) Intersects that represent intersections between roads, (iv) Lanes that represent individual lanes, and (v) Mileposts that provide a second linear referencing method along some Traversals.

[0096] 2. **The Entity-Attribute Data Model.** The TSAF database stores a large number of data items. In order to simplify the user's view of these items, an object-oriented view of the data is provided. Every piece of data maintained by the system is associated with an "Entity". This is done with the Entity-Attribute Data Model. For example, a road characteristic is associated with a road Entity and the length of a bridge is associated with a bridge Entity. The individual pieces of data associated with an Entity are known as attributes.

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[0097]   The Entity-Attribute Data Model does more than provide a simplified view of the data. Because dynamic segmentation is used to store locations along the road network (e.g., where road characteristic values apply), the queries necessary to view data can be very complicated. The Entity-Attribute Data Model provides a method so that the user can easily specify a query (in terms of Entities and attributes), and this query specification can be resolved into an SQL statement that performs the requested query. In this case, the model not only facilitates the specification of the query, but also simplifies the programming necessary to generate the SQL statement that performs the query.

[0098]   Referring now to Figure 13, there is shown is a block diagram showing Entity class types, Entity classes and Entities of the Entity-Attribute Data Model. The Entity-Attribute Data Model achieves this simplification by associating each type of Entity 1300 with a table structure that contains data for that Entity. In particular, each Entity (e.g., a bridge 1301) is part of an Entity class 1310 (e.g., bridges 1311), which has an associated Entity class type 1320 (e.g., road furniture 1321). Each Entity class type 1320 has an associated physical table structure that specifies how data for Entities with that Entity class type are stored. It will be apparent to one skilled in the art that various table structures can be used to implement the system and method, and the examples herein are merely one embodiment.

[0099]   Just as there are several different types of Entities with a physical table structure associated with each type, there are two basic types of attributes 1330

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